

Electrochemical Sensors

Small, low-cost arrays are highly sensitive, extremely versatile, and capable of stand-alone operation

The growing emphasis on environmental issues, waste reduction, and improved efficiency for industrial processes requires better, more cost-effective environmental- and process-monitoring technologies. We are developing multi-element micro-electrode arrays that can be used as both qualitative and quantitative sensors for various chemical species.

Electrochemical sensors are ideally suited for detecting many inorganics, including anions and metal ions, and for measuring pH. Sub-part-per-billion limits of detection are possible for copper, lead, nickel, silver, and other metals. Each element of the multi-element array shown in the figure can be dedicated to the detection of a different chemical species. A nearly unlimited number of array sizes and geometries are possible.

A portable, user-friendly system

We have developed, for use with the sensors, a compact electronics package for experimental control and data acquisition and processing. This system is small enough to be embedded in a laptop computer for a completely self-contained system. These units could be placed

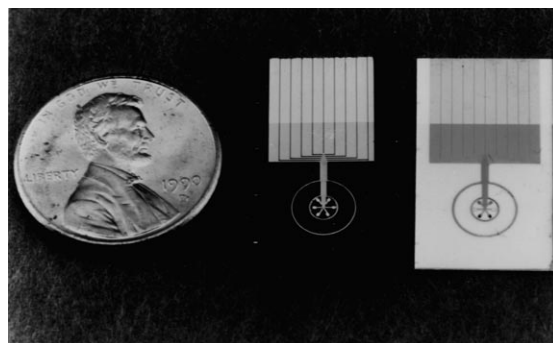
throughout a manufacturing plant or environmental system for a distributed monitoring system. Versatile, user-friendly, and inexpensive to produce, the portable system is well suited for applications in process control, effluent monitoring, and on-site environmental analysis.

APPLICATIONS

- Environmental pollution monitoring
- Industrial, process-control monitoring
- Medical, bedside monitoring

Monitoring pollutants and processes

Waste reduction in electroplating operations is a prime example of how these electrochemical sensors could be used. Electroplating is used throughout U.S. industry for corrosion protection and surface finishing. Electrochemical sensors can monitor the composition of plating baths and rinse systems. These same sensors can also be used to monitor environmental issues and clean-up activities.



Miniature array sensor for multispecies sensing capability.

Monitoring corrosion processes

Electrochemical sensors can also be used to monitor corrosion processes. Corrosion is an electrochemical process that is tied to environmental factors. Sensor arrays can be configured to monitor both the material's response and critical environmental factors, such as pH and chlorine ion concentration.

Other applications

Electrochemical sensors could be used to monitor key ingredients and contaminant levels in oils and lubricants, possibly extending the useful lifetimes of these fluids. In a medical application, electrochemical sensors could be used in bedside monitoring of critical ions in body fluids. Because the sensors are designed for mass production, the unit cost would be low enough to make disposable sensors economically feasible.

Availability: Electrochemical sensors are available now. We are seeking industrial collaborators with whom we can work to develop specific commercial applications for these sensors.

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